Comparing Allelochemicals of English Ivy and Native Georgia Plants

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BACKGROUND

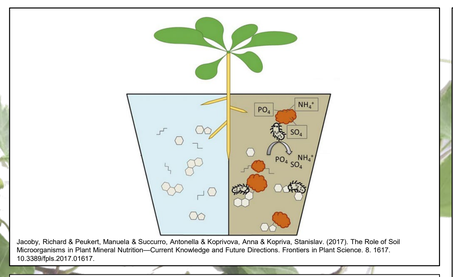
English Ivy at Fernbank Forest

English Ivy (*Hedera helix L.*) is a common invasive plant causing biodiversity losses across the southeast and parts of the northwestern US.

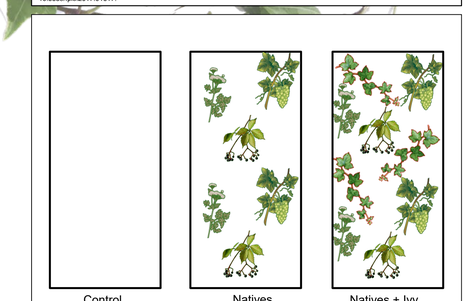
The mechanisms by which Ivy invades native ecosystems are not well understood but may include allelopathy, a process through which one species produces biochemicals that disrupt competitors. These biochemicals are often produced and exuded by roots into soil, making them difficult to isolate.

This study uses a soil-less hydroponic system to examine differences in the chemicals produced by roots of native Georgia plants (Natives) and English Ivy.

METHODS



Jacoby, Richard & Peukert, Manuela & Succurro, Antonella & Koprivova, Anna & Kopriva, Stanislav. (2017). The Role of Soil Microorganisms in Plant Mineral Nutrition—Current Knowledge and Future Directions. Frontiers in Plant Science. 8. 1617. 10.3389/fpls.2017.01617.



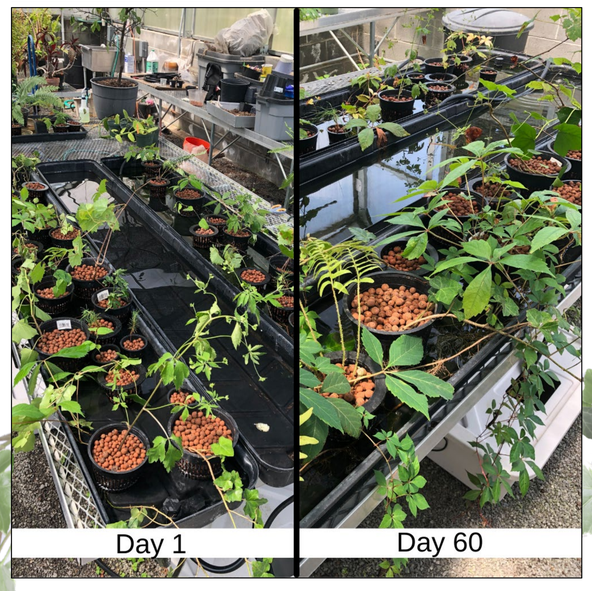
Native plants (e.g. Virginia creeper, muscadine grapes, etc.) and Ivy were collected in Marietta, GA, washed, and transferred to hydroponic systems with growth trays, water reservoirs, and circulating pumps.

Native plants were allowed to grow with or without English Ivy for 42 days. A third tray served as a blank and was kept empty.

Organic chemicals were adsorbed to activated carbon particles submerged in the trays.

On days 14, 28, and 42 extracts from the activated carbon were analyzed using Gas Chromatography-Mass Spectroscopy.

RESULTS



Virginia Creeper Root Growth English Ivy Root Growth

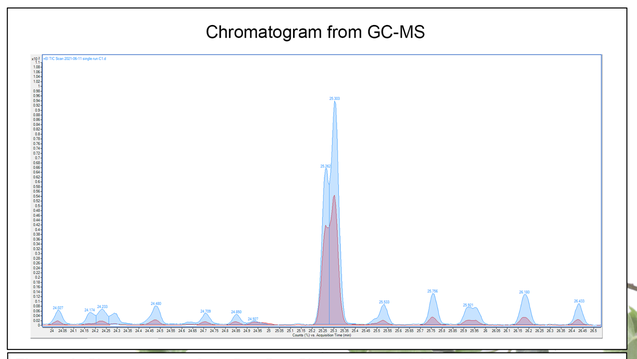


Figure 1. Chromatogram from first Gas Chromatography-Mass Spectroscopy analysis. Peaks at different times correspond to different vaporization points, which allow the chemicals present to be identified.

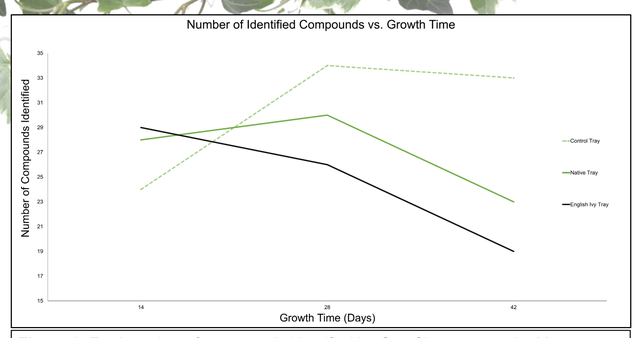


Figure 2. Total number of compounds identified by Gas Chromatography-Mass Spectroscopy over time. Chemical diversity decreased in trays with plants, while diversity in the control tray increased.

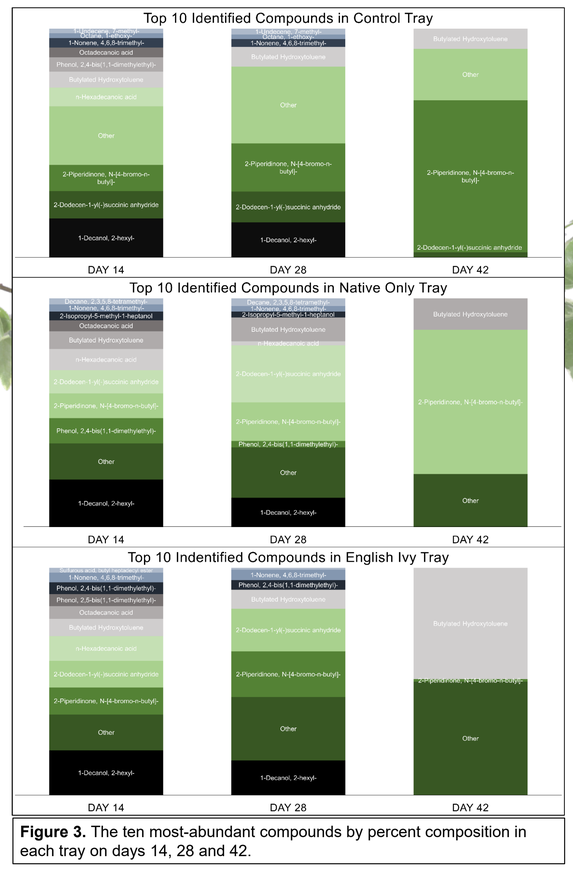
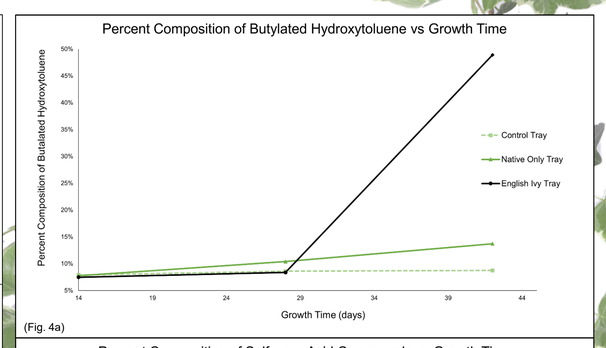
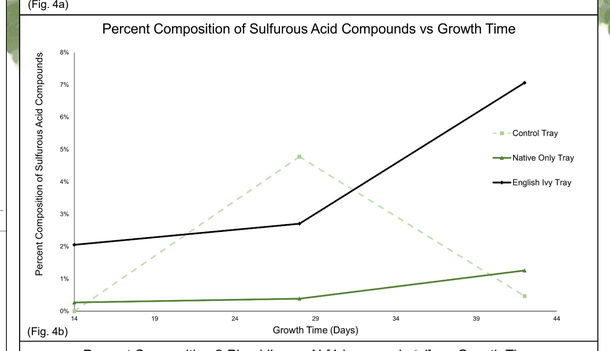


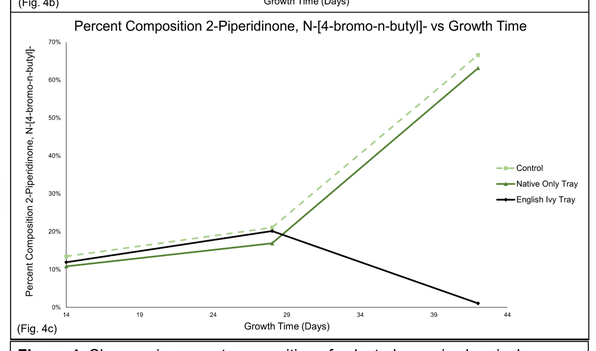
Figure 3. The ten most-abundant compounds by percent composition in each tray on days 14, 28 and 42.



(Fig. 4a)



(Fig. 4b)



(Fig. 4c)

Figure 4. Changes in percent composition of selected organic chemicals detected in hydroponic solution over time.

DISCUSSION

Our results suggest there are differences in the diversity and abundance of root exudates produced by English Ivy and the exudates produced by the natives of Georgia's forests. Because chemical changes over time were not consistent among treatments, native plants and Ivy may alter the soil in unique ways.

In trays containing plants, decreases in compound diversity over time (Figs. 2 and 3) may indicate changes in competitive interactions between plants and microbes. For instance, the presence of Ivy reduced the amount of 2-Piperidinone (Fig. 4c) which was abundant in the control and native treatments.

While the role of the most abundant compounds is unclear, previous research shows that some plants use butylated hydroxytoluene (Fig. 4a) to prevent damage from free radicals, and sulfur compounds (Fig. 4b) may hinder seed germination (Wang, 2016).

Both altered microbial interactions and allelochemicals may allow ivy to outcompete native plants. Further research should explore the potential allelopathy of the chemicals identified here on both plants and soil microbes.

SCAN HERE FOR MORE INFORMATION:

Thank you to Dr. Kyle Gabriel at the BioInnovation Lab for assisting with the GC-MS analysis and to Birla Carbon and Kennesaw State University for the funding that enabled this project.